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Impact of low alcohol verbal descriptors on perceived strength: An experimental study

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Objectives. Low alcohol labels are a set of labels that carry descriptors such as 'low' or 'lighter' to denote alcohol content in beverages. There is growing interest from policymakers and producers in lower strength alcohol products. However, there is a lack of evidence on how the general population perceives verbal descriptors of strength. The present research examines consumers' perceptions of strength (% ABV) and appeal of alcohol products using low or high alcohol verbal descriptors.

Design. A within-subjects experimental study in which participants rated the strength and appeal of 18 terms denoting low (nine terms), high (eight terms) and regular (one term) strengths for either (1) wine or (2) beer according to drinking preference.

Methods. Thousand six hundred adults (796 wine and 804 beer drinkers) sampled from a nationally representative UK panel.

Results. *Low, Lower, Light, Lighter,* and *Reduced* formed a cluster and were rated as denoting lower strength products than *Regular*, but higher strength than the cluster with intensifiers consisting of *Extra Low, Super Low, Extra Light,* and *Super Light*. Similar clustering in perceived strength was observed amongst the high verbal descriptors. *Regular* was the most appealing strength descriptor, with the low and high verbal descriptors using intensifiers rated least appealing.

Conclusions. The perceived strength and appeal of alcohol products diminished the more the verbal descriptors implied a deviation from *Regular*. The implications of these findings are discussed in terms of policy implications for lower strength alcohol labelling and associated public health outcomes.

Statement of contribution

What is already known about this subject?

- Current UK and EU legislation limits the number of low strength verbal descriptors and the associated alcohol by volume (ABV) to 1.2% ABV and lower.
- There is growing interest from policymakers and producers to extend the range of lower strength alcohol products above the current cap of 1.2% ABV set out in national legislation.
- There is a lack of evidence on how the general population perceives verbal descriptors of alcohol product strength (both low and high).

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What does this study add?

- Verbal descriptors of lower strength wine and beer form two clusters and effectively communicate reduced alcohol content.
- *Low, Lower, Light, Lighter,* and *Reduced* were considered lower in strength than *Regular* (average % ABV).
- Descriptors using intensifiers (*Extra Low, Super Low, Extra Light,* and *Super Light*) were considered lowest in strength.
- Similar clustering in perceived strength was observed amongst the high verbal descriptors.
- The appeal of alcohol products reduced the more the verbal descriptors implied a deviation from *Regular*.

Drink-related harm costs the UK Government £21 billion a year (Home Office, Department of Health, Baker, Ellison, Hunt, & May, 2014). Wider availability and marketing through the use of explicit labelling of lower strength alcoholic beverages (i.e., products containing lower than average alcohol by volume, for beers or wine) have the potential to reduce alcohol consumption if they attract more people towards these products. Low alcohol labels are a set of labels that carry descriptors such as 'low' or 'lighter' to denote low or reduced strength alcohol content in alcohol beverages. Current legislation across the European Union (EU) and in the United Kingdom limits the number of terms that can be used and further restricts the use of such descriptors to drinks of 1.2% alcohol by volume (ABV) and lower (The European Parliament and the Council of the European Union, 2011). Similar restrictions apply across the globe with Canada, Australia, and New Zealand limiting the use of such terms to below 1.1–1.15% ABV (see Canadian Food Inspection Agency, 2017; Food Standards Australia & New Zealand, 2014).

The UK national regulations covering the use of low/er alcohol terms were repealed at the end of December 2014, with a sunset clause in place until the end of 2018. This provides an opportunity to consider revisions to allow the industry to use a wider variety of low/er alcohol labels to promote products with alcohol content lower than the current average on the market (which in the United Kingdom is 12.9% for wine and 4.2% for beer; see Department of Health, 2014). This interest is captured in the most recent UK Government Alcohol Strategy published in March 2012 that, amongst other policies, includes an industry pledge through the Responsibility Deal to take one billion units out of the market by 2015, primarily through increasing consumer selection of lower alcohol products (Department of Health, 2012).

Current sales data show that the largest share of sales is dominated by regular (average) strength products on the market (Department of Health, 2014; ONS, 2017), although there is a growing trend especially in high-income countries such as the United Kingdom, USA, Canada, and Germany for consumers to more often buy lower strength alcohol and no-alcohol products ('Big brewers see strong potential for weak beer', 2016; Wine Intelligence, 2013). Increasing consumer selection of lower alcohol products in place of regular strength products forms part of a policy approach to regulate the availability of alcohol, which amongst other initiatives includes physically restricting density of outlets, reducing the hours and days of sale, regulating the minimum legal purchase age, and offering different availability by alcohol strength (for comprehensive reviews of this and other alcohol policies see Babor *et al.*, 2010; Burton *et al.*, 2017).

We are unaware of any direct evidence of the impact of highlighting the alcohol strength of products (either as low or as high) on perceptions of alcohol, its selection or consumption. While increasing the availability of lower strength alcohol products has the potential to reduce the number of alcohol units consumed, this will depend upon a number of assumptions including: (1) the price of lower strength alcohol products being

lower when compared to regular strength products (with price being an important driver of sales); (2) lower strength alcohols being selected instead of higher strength alcohols as opposed to increasing the number of opportunities perceived suitable for consuming alcohol (see also Rehm, Lachenmeier, Jané-Llopis, Imtiaz, & Anderson, 2016); and (3) labels highlighting lower alcohol strength not engendering a self-licensing effect (i.e., giving oneself permission to act indulgently following a virtuous choice) such that people over-consume lower strength alcohol resulting in consumption of more units than would have been consumed from a higher strength product (Khan & Dhar, 2006). The current study focuses on the last two assumptions.

In the absence of studies examining the impact of low/er alcohol labels or labels denoting other strengths of alcohol, we summarize below the studies that have assessed the impact of warning labels and labels showing alcohol units which may provide indirect evidence regarding the possible impact of alcohol labels denoting low/er alcohol strengths. While textual warning labels highlighting recommended consumption levels and possible harm from alcohol report increased awareness of these labels and recommendations, no studies assessing consumption report effects of these labels on alcohol consumption (Agostinelli & Grube, 2002; Stockwell, 2006; Wilkinson & Room, 2009). A focus group study of students in Australia reported that alcohol unit labels were used to purchase the cheapest alcohol by unit, the label being used as a reference cue to purchase stronger and cheapest alcohol products, thus highlighting a possible negative effect of more prominent labelling of the alcohol content of drinks (Jones & Gregory, 2009; see also Bui, Burton, Howlett, & Kozup, 2008).

When no verbal descriptors of strength are available for guidance, general population knowledge of the alcohol content of drink servings is poor, with most people underestimating the alcohol content of standard glass servings of wine and alcopops (with 37% and 27%, respectively, making accurate judgements). Judgements for beer are better (63% judge correctly) although over a third of respondents were inaccurate (ONS, 2010). Such underestimations are also apparent when examining drink pouring amongst young drinkers (De Visser & Birch, 2012; Furtwängler & de Visser, 2017a,b). At present, it remains unclear whether similar under- or over-estimates can be observed when verbal descriptors of strength are present.

Labels indicating low or light versions of products with health harms (e.g., high fat foods and tobacco) suggest the potential for unintended paradoxical effects, including greater appeal and consumption of total calories when foods are labelled 'low fat', and perceived lower harm from cigarettes labelled as 'light' (Borland *et al.*, 2004; Hammond & Parkinson, 2009; Kozlowski & Pillitteri, 2001; Kozlowski *et al.*, 1998; McCann *et al.*, 2013; Wansink & Chandon, 2006). For example, foods labelled low fat gain a 'health halo' which leads consumers to prefer these products and consume more calories than when presented with the same foods without the labels (Crockett *et al.*, under review; McCann *et al.*, 2013). This self-licensing effect for overconsumption is most pronounced amongst high consumers (Wansink & Chandon, 2006). Similarly, the use of 'light', 'lighter', and 'mild' labels for cigarettes has a misleading effect on perceived product harm and benefits (Borland *et al.*, 2004; Hammond & Parkinson, 2009; Kozlowski & Pillitteri, 2001; Kozlowski *et al.*, 1998). Smokers perceive cigarettes with such labels to contain less tar and to pose a lower health risk compared to cigarettes without such labels. Furthermore, smokers believe that cigarettes labelled with 'light' labels facilitate quitting efforts. A recent systematic review summarizing studies of product labelling denoting low content in food ($k = 19$) and tobacco ($k = 6$), with no studies identified regarding alcohol content labelling, supported the above findings by showing that such labels can alter people's

perceptions concerning the content of products, and (with respect to food) what they judge to be an appropriate serving, with the potential to license consumption of the labelled product (Shemilt, Hendry, & Marteau, 2017).

Present research

Public understanding of alcohol strength of products labelled with different verbal descriptors is an important consideration in any change to the legislative framework governing such terms to ensure good understanding across the population, including those with low as well as high levels of education. Understanding the appeal of different alcohol strength verbal descriptors is also important as a guide towards the potential impact of such labels upon selection and consumption.

Appeal is an attitude, affective in origin, involving positive and negative feelings towards an object or behaviour (see Ajzen, 2001 for a discussion of the relationship between attitudes and behaviour). Affect takes primacy in influencing many judgements and much behaviour (see Strack & Deutsch, 2004). In line with this, appeal of alcohol predicts subsequent alcohol consumption (Conner, Warren, Close, & Sparks, 1999; Morgenstern, Isensee, Sargent, & Hanewinkel, 2011). Furthermore, as past research has found that higher motivation to reduce consumption is associated with greater change in consumption behaviours (Deci & Ryan, 1980; DiClemente, Bellino, & Neavins, 1999), possible moderating effects of motivation to reduce consumption on perceived strength and appeal should also be examined.

Given that prior research in food and tobacco suggests that some people self-license by overindulging in low strength labelled products following a virtuous choice (Khan & Dhar, 2006), it is also important to examine how different verbal descriptors of alcohol strength may be perceived by those with a high versus low inclination to self-license.

This study examined consumers' perceptions of strength and appeal of alcohol products with different verbal descriptors relating to low/er (e.g., *Light*, *Lighter*, *Low*, *Lower*, *Reduced*, *Super Low*, *Extra Low*, *Extra Light*, *Super Light*) alcohol content, and to provide a more complete account of verbal strength descriptors, a selection of higher strength verbal descriptors was also included (e.g., *High*, *Strong*, *Stronger*, *Higher*, *Super Strength*, *Extra Strong*, *Extra High*, *Super High*).

The alcohol content contained in wine has steadily increased in the past 40 years (from 9% ABV to 12–16.5% ABV), with similar increases in beer (from 3.5 to 4% ABV to 5–6.5% ABV) (Morleo, Phillips-Howard, Cook, & Bellis, 2008) This increase in the alcohol content of wines and beers has sometimes been reflected in the labelling of these beverages across the United Kingdom and EU. However, thus far there is no empirical evidence as to how people perceive the strength of different high verbal descriptors in relation to wine and beer, nor what the appeal of such labelled products is. The aim of our study was to fill this gap in our understanding and examine how people perceive and like wines and beers labelled with verbal descriptor denoting low/er or high/er alcohol strength.

Methods

Design

A within-subjects experimental study in which participants rated the strength and appeal of 18 terms denoting low (nine terms), high (eight terms), and regular (one term) strengths for either (1) wine or (2) beer according to drinking preference.

Participants

A total of 1,600 adults (796 wine and 804 beer drinkers) completed the study. Participants were recruited by a market research agency. The sample that accessed the study was nationally representative for age, sex, SES, and geographical region in the United Kingdom. Only those who reported drinking alcohol at least once per week were eligible to participate. Furthermore, participants who failed attention checks were not permitted to complete the study (Oppenheimer, Meyvis, & Davidenko, 2009). Attention was gauged by a single item: *When was the last time you have flown to Mars? Please answer honestly and to the best of your knowledge: Never/A few days ago/Weeks ago/Months ago*. Participants who did not choose the only plausible option of 'Never' were considered inattentive and were prevented from continuing with the study. Allocation to the wine or beer samples was done according to drinking preference (see also Procedure). Table 1 provides demographic and other characteristics of the two samples. The final sample size of 1,600 participants provided 90% power at 5% level of significance to detect a small sized difference (0.2 *SD*) in perceived alcohol strength for (1) wine and (2) beer, between one 'low alcohol' and another of the 'low alcohol' verbal descriptors, taking into account multiple comparisons and using the effect size derived from a pilot study (Vasiljevic, Couturier, & Marteau, 2015).

Verbal descriptors

The verbal descriptors tested were as follows:

1. *Low:* low, light, lower, lighter, reduced, extra low, super low, extra light, super light.
2. *High:* high, strong, higher, stronger, extra strong, super strength, extra high, super high.
3. *Regular*: regular.

The different verbal descriptors were chosen to allow us to examine differences in perceptions between *absolute* terms (low, light, high, strong, regular), *relative* terms (lower, lighter, reduced, higher, stronger), and *terms with intensifiers* (extra low, super low, extra light, super light, extra strong, super strength, extra high, super high).

Measures

Primary outcome

Perceived alcohol strength. This was recorded for each of the verbal descriptors using a slider ranging from 0% ABV (alcohol by volume) to 26% ABV. Participants read the following instructions: *The average strength of wine (beer) in the UK is 12.9% (4.2%). Below are 10 words that describe the alcohol strength of different wines (beers). Please use the sliders next to each of these 10 words to show how strong you would expect a wine (beer) labelled with these words to be. Please note: 0 denotes Lowest Strength and 26 denotes Highest Strength. On the right-hand side of the slider you will be able to see the value you have chosen.*

Secondary outcome

Product appeal (liking). This was recorded for each of the verbal descriptors using a slider ranging from 0% to 100%. Participants read the following instructions: *Below are 10 words that describe the alcohol strength of different wines (beers). Please use the sliders next to each of these 10 words to show how much you would like to drink a wine (beer)*

Table 1. Participant demographic and other characteristics

Variable	Wine (n = 796)	Beer (n = 804)
Sex		
Male	364 (46)	631 (78)
Female	432 (54)	173 (22)
Age group		
18–35	71 (9)	157 (19)
36–45	125 (16)	160 (20)
46–60	251 (31)	270 (34)
61–99	349 (44)	217 (27)
Education		
Up to 4 GCSE's	112 (14)	141 (17)
1 A-level	122 (15)	127 (16)
2+ A Levels	145 (18)	144 (18)
University	379 (48)	352 (44)
NA	38 (5)	40 (5)
Income		
0–15.5K pa	117 (14)	153 (19)
15.5K–25.5K pa	132 (17)	144 (18)
25.5K–40K pa	252 (32)	225 (28)
>40K pa	252 (32)	248 (31)
NA	43 (5)	34 (4)
Social grade		
Low	105 (13)	92 (12)
Medium	113 (14)	140 (17)
High	306 (39)	290 (36)
NA	272 (34)	282 (35)
Index of Multiple Deprivation (IMD)		
Quintile 1	82 (10)	116 (14)
Quintile 2	128 (16)	164 (20)
Quintile 3	141 (18)	128 (16)
Quintile 4	164 (21)	127 (16)
Quintile 5	167 (21)	128 (16)
NA	114 (14)	141 (18)
Motivation to reduce consumption		
Quartile 1	255 (32)	277 (35)
Quartile 2	240 (30)	244 (30)
Quartile 3	166 (21)	145 (18)
Quartile 4	135 (17)	138 (17)
Self-licensing		
Quartile 1	233 (29)	197 (25)
Quartile 2	232 (29)	227 (28)
Quartile 3	198 (25)	200 (25)
Quartile 4	133 (17)	180 (22)
Frequency of drinking		
Quartile 1	288 (36)	201 (25)
Quartile 2	215 (27)	180 (22)
Quartile 3	190 (24)	248 (31)
Quartile 4	103 (13)	175 (22)

Continued

Table 1. (*Continued*)

Variable	Wine (n = 796)	Beer (n = 804)
Riskier drinkers		
No	503 (63)	381 (47)
Yes	293 (37)	423 (53)
Numeracy		
High	600 (75)	624 (78)
Low	196 (25)	180 (22)
Ethnicity		
White	737 (93)	728 (91)
Other	59 (7)	76 (9)

Note. Percentages (%) appear in parentheses.

labelled with these words. Please note: 0 denotes Lowest Liking and 100 denotes Highest Liking. On the right-hand side of the slider you will be able to see the value you have chosen.

Other measures

Risky drinking. This was assessed using the AUDIT-C (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) the first three items of the Alcohol Use Disorders Identification Test (AUDIT, Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). A sample item asked '*How many drinks containing alcohol do you have on a typical day when you are drinking?'* responses ranged from *1 or 2, 3 or 4, 5 or 6, 7 to 9, 10 or more*. Following recommendations, responses to the three items were summed and then dichotomized to denote riskier (scoring above 5) versus less risky drinking patterns (scoring below 5) (see Public Health England, 2017).

Motivation to reduce consumption. Three items were used to measure intentions and desire to drink less within the next six months: *'Thinking about the next 6 months: I intend to drink less alcohol/I want to drink less alcohol/I will try to drink less alcohol.'* Responses were recorded on 7-point scales ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Responses to the three items were averaged into a single index for wine and beer, respectively (α = .96 for both samples).

Self-licensing. This was assessed using two items: *'If I were to have a low alcohol drink, I would feel like I deserved to have something stronger for my next drink'* and *'If I were to have a low alcohol drink, I would feel like I could have more than my usual number of drinks'*. The items were rated on 7-point scales ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Indices averaging the two items were made (r_{wine} = .54; r_{beer} = .49).

Numeracy. This was assessed using a single item from Lipkus, Samsa, and Reimer's (2001) Numeracy Scale (validated by Wright, Whitwell, Takeichi, Hankins, & Marteau, 2009): '*Which of the following numbers represents the biggest risk of getting a disease: 1 in 100 risk of getting a disease; 1 in 1,000 risk of getting a disease; 1 in 10 risk of getting*

a disease?' For analyses, answers were dichotomized into those who answered correctly versus those who answered incorrectly.

Demographic characteristics. The following were recorded: age, sex, ethnicity, and socio-economic status (assessed using *individual-level measures* of highest educational qualification, income and occupational status, and *area-level deprivation* assessed from postcode information) (see Oguz, Merad, & Snape, 2013).

Procedure

The study received ethics approval from the University of Cambridge Psychology Research Ethics Committee (Pre.2014.110). Participants were recruited by a research agency. Only those participants who reported drinking at least once a week were eligible to proceed with the study. Participants then stated their alcohol preference (wine or beer) and on the basis of this were allocated to respond to the verbal descriptors for either (1) wine or (2) beer. This sampling strategy is in line with recent national surveys canvassing the drinking habits of the UK population (ONS, 2010, 2016). Those participants who reported that they drink wine and beer in equal proportion were randomly assigned to either the wine or beer surveys. Participants who reported that they did not drink wine or beer were ineligible and were stopped from further participation. Eligible participants first rated the primary and secondary outcomes for the 18 different verbal descriptors which appeared in counterbalanced order between participants. Randomization and counterbalancing of the measures was achieved by an algorithm embedded in the online survey software, *Qualtrics*. Participants were then asked to complete the remaining study measures.

Analyses

As the pilot data showed many outliers, a decision was taken a priori to use the medians as measures of central tendency for the perceived strength and liking (appeal) of each verbal descriptor. Scores were analysed in absolute terms as well as relative to the *Regular* verbal descriptor (by dividing scores for the labels of interest by the scores for the *Regular* verbal descriptor; divisions by 0 were treated as missing values). Pairwise comparisons of the perceived strength and liking of low (high) verbal descriptors were also performed to determine significant differences between the verbal descriptors.

Confidence intervals for medians of the perceived strength and liking of each verbal descriptor of the wine and beer samples and for all pairwise comparisons were obtained by means of nonparametric bootstraps. As a within-subjects design was used, participants' perceived strength and liking scores were correlated calling for a multiplicity correction that takes the dependencies in the data into account. This method assumes that under the set of null hypotheses, the standardized parameters of interest follow a multivariate normal distribution with mean 0 and a (non-identity) correlation matrix. Cutting values are deduced by integration of the multivariate normal density after estimation of the parameter correlation matrix (Bretz, Hothorn, & Westfall, 2010).

Linear mixed models with random effects for participants were used to estimate the perceived strength and liking of the verbal descriptors of interest relative to the *Regular* verbal descriptor while taking into account the participant dependence. Due to the presence of outliers, robust linear mixed models were used, as they allow consistent and efficient

estimates under model misspecifications (Heritier, Cantoni, Copt, & Victoria-Feser, 2009). The mixed model analysis of perceived strength and liking was performed on scores relative to the *Regular* verbal descriptor score as the variance of the perceived strength of the *Regular* verbal descriptor was close to 0 (as the average strength of wine and beer in the United Kingdom was specified in the instructions for participants, see Methods), and the amount of outliers was lower on the relative scale for both outcomes.

Results

Primary outcome

Perceived alcohol strength

Figure 1 shows the perceived strength of low verbal descriptors for the wine and beer samples. The boxplots of participants' scores show a large number of outliers with scores spreading from 0% to 26% ABV for almost all verbal descriptors. *Low, Lower, Light, Lighter,* and *Reduced* were perceived to denote products lower in strength (wine: 6.7–8.3%, beer: 2.7–3.1%) than *Regular* (average % ABV), but higher in strength than *Extra Low, Super Low, Extra Light,* and *Super Light* (wine: 3.5–4.8%, beer: 1.3–2.2%). Median confidence intervals (global type I error set to 5%) show that a majority of participants perceived the alcohol content of products labelled with low descriptors as far higher in strength than the currently legislated cap of 1.2% ABV for any product using a label 'low' in relation to alcohol content. Indeed, only the confidence interval for the median of the perceived strength of *Super Low* beer contained 1.2% in its range (see Table 2).

Analyses were also conducted with regard to participants' ratings of perceived strength relative to their ratings of the *Regular* verbal descriptor. This approach allows for a more direct comparison of how verbal descriptors may alter individuals' perceptions of the alcohol content for wine and for beer as both beverages differed in average % ABV. As shown in Figure S1, the impact of verbal descriptors on individuals' perceptions of strength was very similar for wine and for beer.

Figure 2a and b, respectively, show the comparison of the median perceived strength for all possible pairs of low descriptors for wine and beer. All descriptors were perceived significantly lower in strength when compared to *Regular*. Amongst the cluster of single adjectives, *Low* was perceived as most distinct from *Regular* and, amongst the cluster of adjectives paired with intensifiers, *Super Low* was perceived as most distinct from

Table 2. Median strength ratings and 95% CIs for low verbal descriptors

Verbal Descriptor	Wine Median (95% CI)	Beer Median (95% CI)
Regular	12.9 (12.9, 12.9)	4.2 (4.2, 4.3)
Low	6.7 (6.1, 7.0)	2.7 (2.4, 2.8)
Light	7.2 (6.8, 7.8)	3.1 (3.0, 3.3)
Lower	8.0 (7.7, 8.6)	3.0 (2.8, 3.1)
Lighter	7.9 (7.5, 8.3)	3.1 (3.0, 3.3)
Reduced	8.3 (7.9, 8.7)	3.0 (2.9, 3.2)
Extra low	3.8 (3.6, 4.4)	1.6 (1.5, 1.8)
Super low	3.5 (3.0, 3.8)	1.3 (1.1, 1.5)
Extra light	4.8 (4.4, 5.1)	2.2 (2.0, 2.5)
Super light	4.1 (3.7, 4.6)	1.9 (1.7, 2.1)

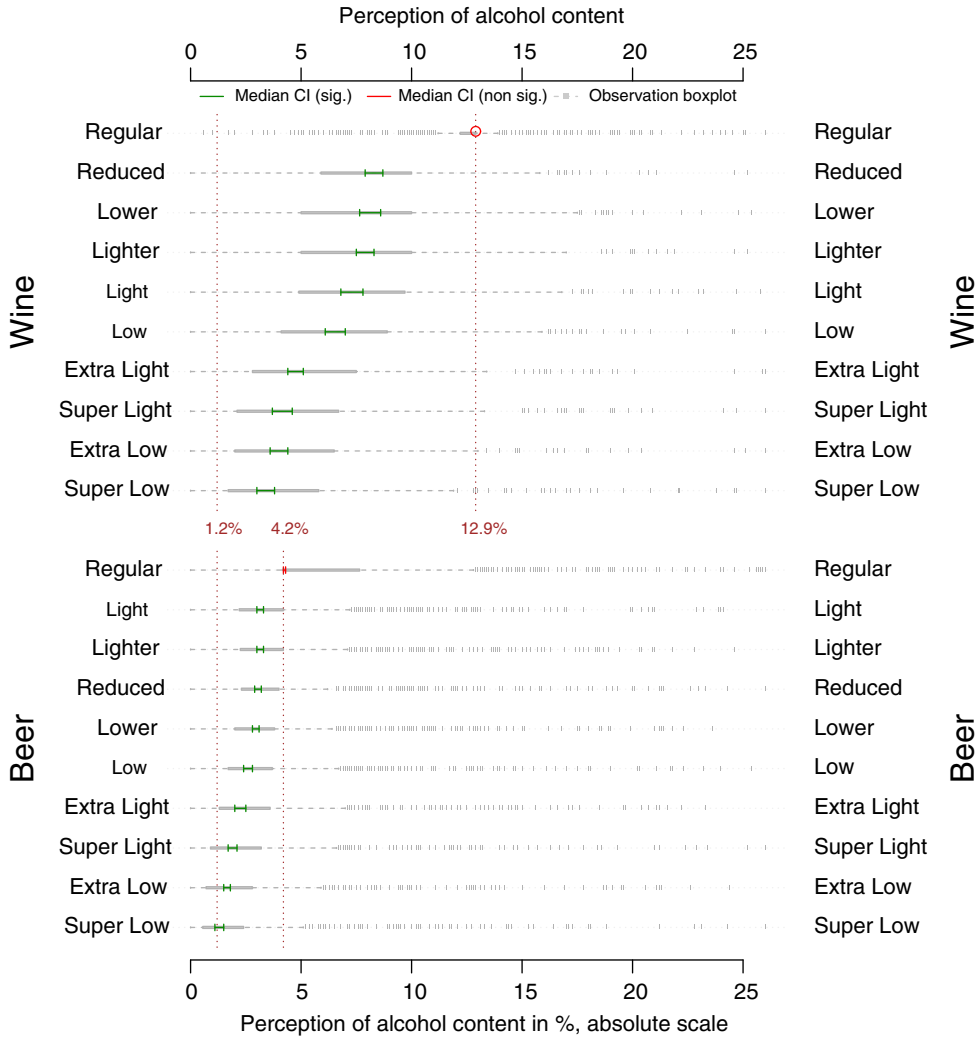

Figure 1. Perceived strength of low verbal descriptors for wine and beer. The boxplots of participants' scores appear in grey. Confidence intervals for the medians appear in green if medians are significantly different from the average strength of wine/beer and in red otherwise. The global type I error was set to .05. Descriptors are ordered according to their median score within each drink. Dotted red lines denote the average alcohol contents for regular wine and beer, respectively, as well as the legislated cap of 1.2% ABV for 'low' alcohol products. Red circle denotes that the lower and upper bound of CI are equal (i.e., perfect agreement).

Regular (with distinctiveness defined as having the lowest median). Furthermore, based on the number of significant pairwise comparisons between descriptors, both *Low* and *Super Low* were the most differentiated labels within the cluster of single adjectives and adjectives with intensifiers, respectively (with the exception of *Extra Light*, which was perceived highest in strength amongst the cluster of adjectives with intensifiers, and for beer, was not significantly different from *Low*). Closer examination of the semantic meaning of verbal descriptors denoting absolute strength (*Low*, *Light*) versus relative strength (*Lower*, *Lighter*) revealed no significant differences in perceived strength.

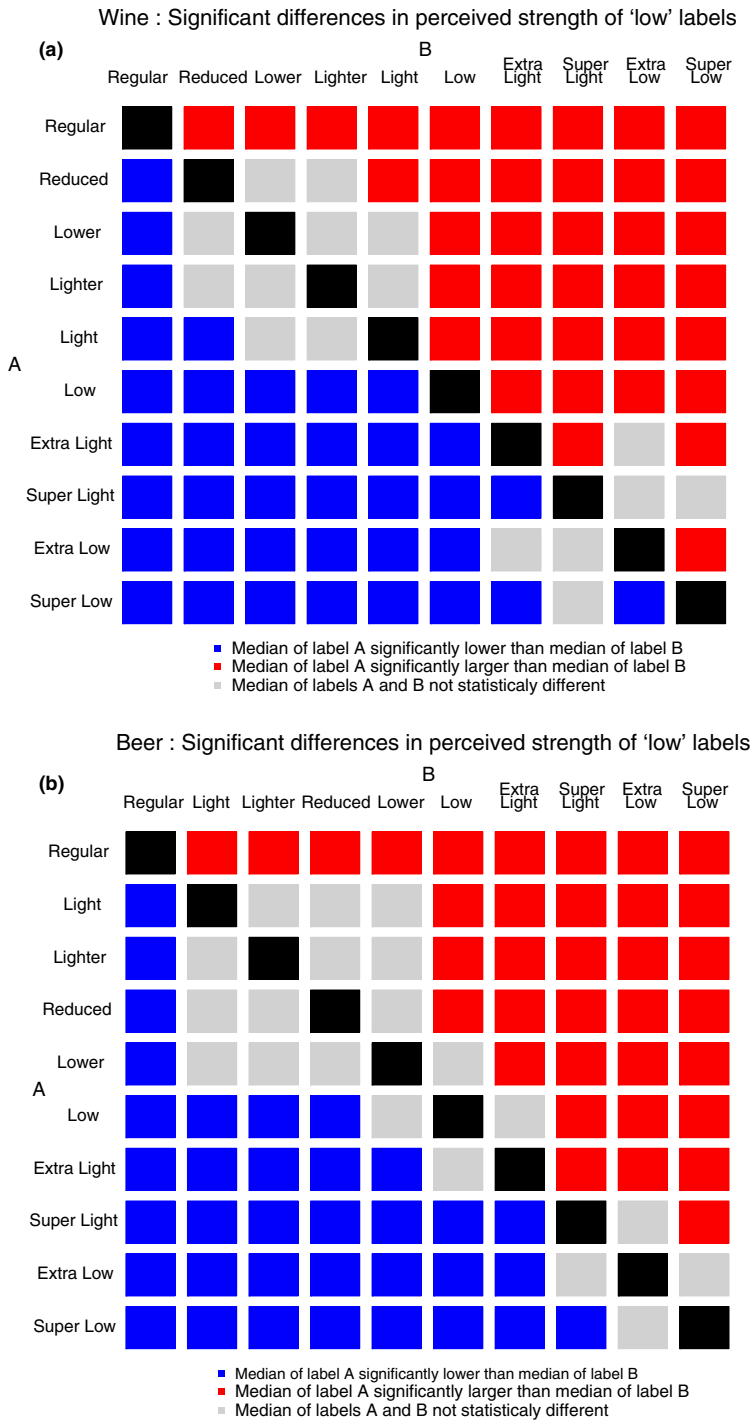

Figure 2. (a and b) Pairwise comparison of low verbal descriptors for wine and beer. For each pair, statistically different medians appear in colour (blue if median of verbal descriptor A is statistically lower than that of verbal descriptor B and red if larger) and in grey if not statistically different. The global type I error was set to .05.

Similar analyses on the *high* verbal descriptors revealed that *High, Strong, Higher,* and *Stronger* were perceived to denote products higher in strength (wine: 14.8–14.9%, beer: 6.3–6.4%) than *Regular* (average %ABV; wine: 12.9%, beer: 4.2%), but lower in strength than *Extra Strong, Super Strength, Extra High,* and *Super High* (wine: 16.55–17.15%, beer: 8–9%) [see Figure 3 and Table 3]. This corroborates the finding amongst low strength verbal descriptors that the verbal labels are perceived to denote two clusters of strength – one with and one without intensifiers. Graphical representation of the results on the relative scale can be seen in Figure S2.

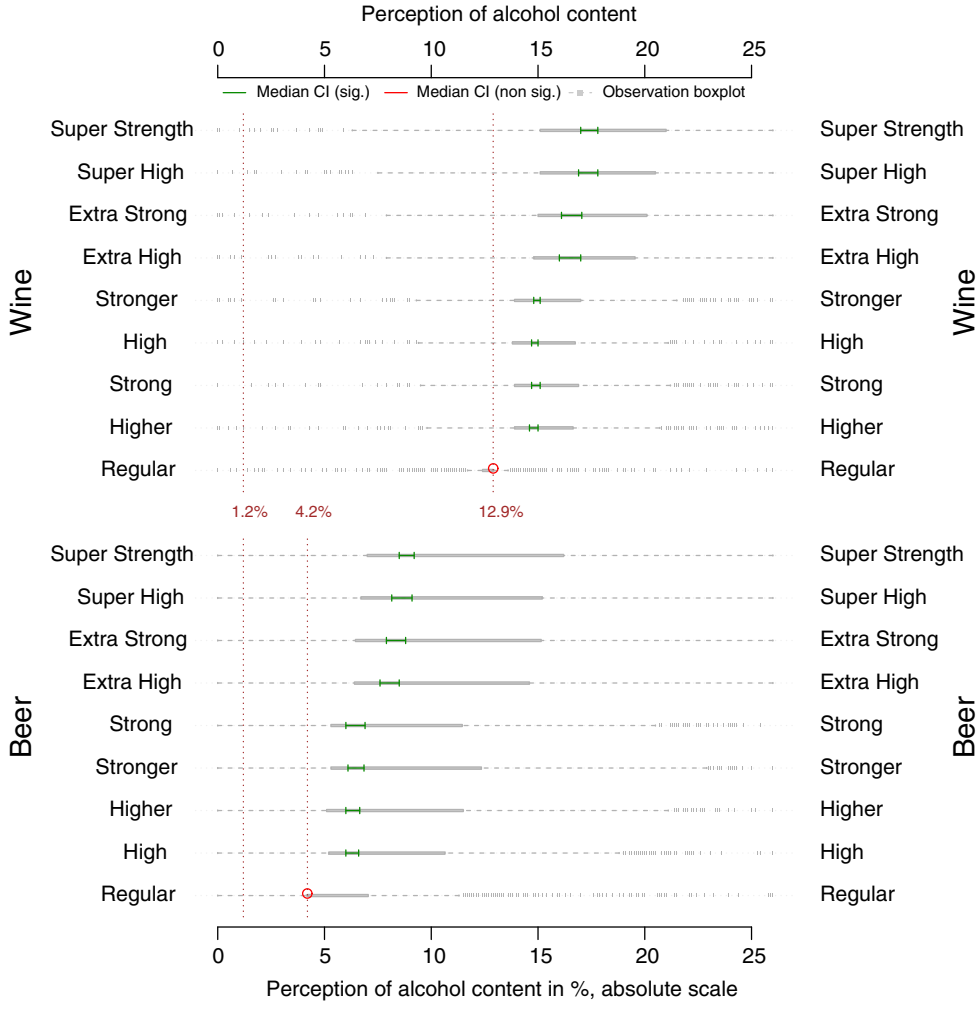

Figure 3. Perceived strength of high verbal descriptors for wine and beer. The boxplots of participants' scores appear in grey. Confidence intervals for the medians appear in green if medians are significantly different from the average strength of wine/beer and in red otherwise. The global type I error was set to .05. Descriptors are ordered according to their median score within each drink. Dotted red lines denote the average alcohol contents for regular wine and beer, respectively, as well as the legislated cap of 1.2% ABV for 'low' alcohol products. Red circle denotes that the lower and upper bound of CI are equal (i.e., perfect agreement).

Table 3. Median strength ratings and CIs for high verbal descriptors

Verbal Descriptor	Wine Median (95% CI)	Beer Median (95% CI)
Regular	12.9 (12.9–12.9)	4.2 (4.2–4.2)
High	14.9 (14.7–15.0)	6.3 (6.0–6.6)
Strong	14.9 (14.7–15.1)	6.4 (6.0–6.9)
Higher	14.8 (14.6–15.0)	6.3 (6.0–6.65)
Stronger	14.9 (14.8–15.1)	6.4 (6.1–6.85)
Extra strong	16.6 (16.1–17.05)	8.3 (7.9–8.8)
Super strength	17.15 (17.0–17.8)	9.0 (8.5–9.2)
Extra high	16.55 (16.0–17.0)	8.0 (7.6–8.5)
Super high	17.0 (16.9–17.8)	8.7 (8.15–9.1)

Secondary outcome

Product appeal

Regular was the most appealing strength descriptor, with the low verbal descriptors using the intensifiers *Extra* and *Super* rated least appealing (using both absolute and relative scores, see Figure 4 below and Figure S3).

Similarly, participants rated the *high* verbal descriptors as lower in appeal when compared to *Regular*, with the high verbal descriptors coupled with intensifiers rated least appealing (see Figure 5 and Figure S4).

Other measures

Moderators of strength and liking of low alcohol verbal descriptors

Robust mixed model results (with global type I error set at 5%) yielded no evidence that perceived strength or appeal of products described using the different low verbal descriptors varied by age, sex, socio-economic status, ethnicity, risky drinking, or numeracy (see Tables 4-7).

Those with higher, compared with a lower, motivation to reduce alcohol consumption in the next 6 months perceived the low verbal descriptors as higher in strength and more appealing. Finally, the analyses also showed that high self-licensing led to lower liking of the low verbal descriptors. This effect was found for wine, but not for beer.

Moderators of strength and liking of high alcohol verbal descriptors

There was an effect amongst males aged 35–45 years who, compared to the overall mean, perceived the different high verbal descriptors as denoting lower alcohol strength (see Tables 8-11). This effect was only found for wine and not for beer.

Those who were high in self-licensing liked the high verbal descriptors more than those low in self-licensing. This was found for both wine and beer.

Discussion

Verbal descriptors of lower strength alcohol wine and beer form clusters and can effectively communicate two categories of strength that are significantly lower than an average (*Regular*) strength product (in the United Kingdom: 12.9% ABV for wine and 4.2%

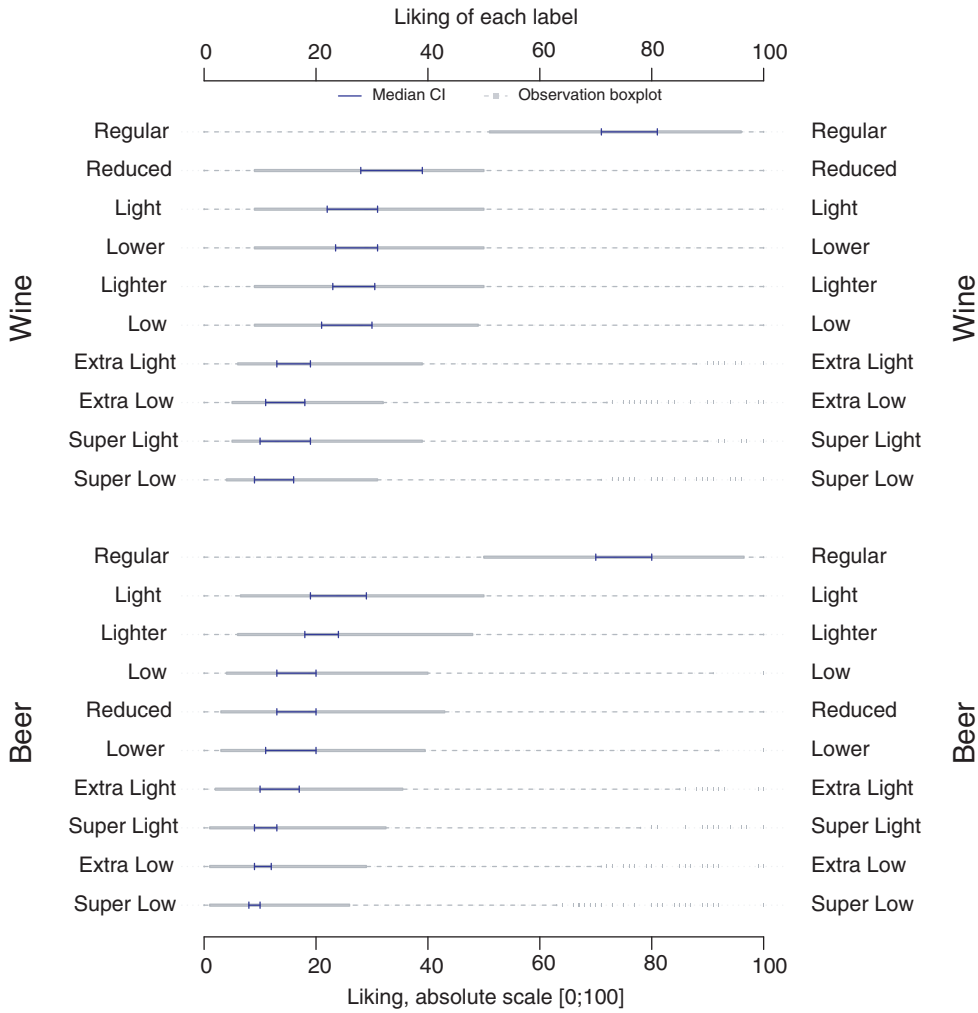

Figure 4. Liking of low verbal descriptors for wine and beer. The boxplots of participants' scores appear in grey. Confidence intervals for the medians appear in blue. The global type I error was set to .05. Descriptors are ordered according to their median score within each drink.

ABV for beer). Seventeen of 18 verbal descriptors for lower strength products were perceived as denoting products far higher in strength than the currently legislated cap of 1.2% ABV for alcohol products that can legitimately use the descriptor 'low'. *Low, Lower, Light, Lighter,* and *Reduced* formed a cluster and were considered lower in strength than *Regular* (average % ABV), but higher in strength than the cluster consisting of *Extra Low, Super Low, Extra Light,* and *Super Light*. Similar clustering in perceived strength was observed in responses to the verbal descriptors denoting higher than *Regular* alcohol strength.

Regular was the most appealing strength descriptor, with the low and high verbal descriptors using *intensifiers* rated least appealing. The appeal of alcohol products reduced the more the verbal descriptors implied a deviation from *Regular*.

The findings on perceived strength align with prior research on general population knowledge of serving units (ONS, 2010) and indicate that people also have poor

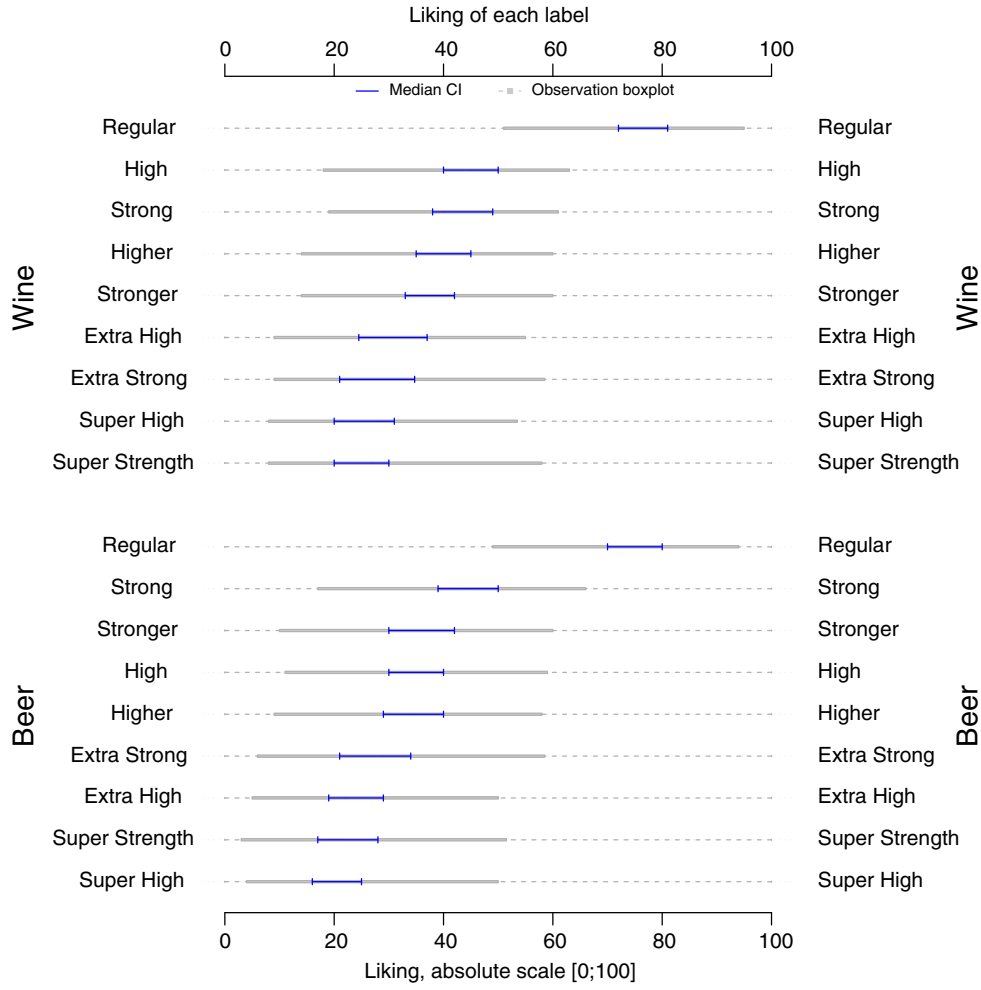

Figure 5. Liking of high verbal descriptors for wine and beer. The boxplots of participants' scores appear in grey. Confidence intervals for the medians appear in blue. The global type I error was set to .05. Descriptors are ordered according to their median score within each drink.

knowledge of current legislated limits of strength. The findings on appeal fit with current sales data showing consumers prefer regular strength products. The findings on appeal also extend prior empirical evidence on the understanding of alcohol unit labels showing that consumers use these labels to select higher strength alcohol drinks (Bui *et al.*, 2008; Jones & Gregory, 2009). However, the finding that participants' found the products denoted with the *Regular* strength verbal descriptors as most appealing also suggests that consumers do not necessarily prefer alcoholic beverages with the highest alcohol content. Rather it seems that consumers prefer the common drinks that are available on the market, possibly due to familiarity or mere exposure effects (see Zajonc, 1968). Future studies should examine the mechanisms driving these effects.

The results of robust mixed models also showed that participants' age, sex, ethnicity, SES, risky drinking habits, and numeracy did not moderate the effects of low alcohol verbal descriptors on perceived strength and appeal. A similar pattern was found for high alcohol

Table 4. Robust mixed models for perceived strength for low verbal descriptors in wine drinkers

Variable	Estimate	*SE*	z-Value	Pr(>|z|)
Verbal descriptor				
(Intercept)	0.719	.013	56.850	<.001*
Low	0.042	.004	10.403	<.001*
Light	0.064	.004	15.982	<.001*
Lower	0.090	.004	22.463	<.001*
Lighter	0.078	.004	19.333	<.001*
Reduced	0.101	.004	25.134	<.001*
Extra low	−0.089	.004	−22.231	<.001*
Super low	−0.131	.004	−32.675	<.001*
Extra light	−0.057	.004	−14.128	<.001*
Super light	−0.098	.004	−24.280	<.001*
Sex				
Male	0.012	.007	1.638	.101
Female	−0.012	.007	−1.638	.101
Age group				
[18,35]	0.044	.017	2.549	.011
[35,45]	−0.004	.012	−0.346	.729
[45,60]	−0.027	.010	−2.588	.010
[60,99]	−0.013	.010	−1.249	.212
Education				
Up to 4 GCSE's	−0.011	.013	−0.865	.387
1 A-level	−0.007	.012	−0.594	.553
2+ A Levels	0.005	.011	0.463	.644
University	0.013	.009	1.450	.147
Income				
[0, 15.5K] GBP/year	−0.020	.012	−1.583	.113
[15.5K, 25.5K] GBP/year	0.009	.012	0.763	.446
[25K, 40K] GBP/year	−0.005	.009	−0.566	.571
More than 40K GBP/year	0.016	.010	1.644	.100
Motivation				
–	0.002	.006	0.271	.786
Self-licensing				
–	−0.006	.006	−1.077	.281
Risk				
Low	0.002	.006	0.376	.707
High	−0.002	.006	−0.376	.707
Numeracy				
Correct	−0.009	.007	−1.246	.213
Wrong	0.009	.007	1.246	.213
Ethnicity				
White	−0.011	.011	−1.007	.314
Other	0.011	.011	1.007	.314
Interaction				
[18,35] male	−0.015	.017	−0.874	.382
[35,45] male	0.020	.012	1.583	.113
[45,60] male	−0.011	.010	−1.081	.280
[60,99] male	0.006	.010	0.640	.522

Note. *$p < .05$ when correcting for multiple comparisons.

Table 5. Robust mixed models for perceived strength for low verbal descriptors in beer drinkers

Variable	Estimate	*SE*	*z*-Value	Pr(>|z|)
Verbal descriptor				
(Intercept)	0.718	.014	52.754	<.001*
Low	0.034	.005	7.044	<.001*
Light	0.092	.005	19.298	<.001*
Lower	0.072	.005	15.180	<.001*
Lighter	0.093	.005	19.589	<.001*
Reduced	0.094	.005	19.638	<.001*
Extra low	−0.117	.005	−24.563	<.001*
Super low	−0.166	.005	−34.689	<.001*
Extra light	−0.026	.005	−5.359	<.001*
Super light	−0.077	.005	−16.137	<.001*
Sex				
Male	0.011	.008	1.249	.212
Female	−0.011	.008	−1.249	.212
Age group				
[18,35]	0.029	.014	2.070	.038
[35,45]	−0.014	.016	−0.869	.385
[45,60]	0.013	.014	0.917	.359
[60,99]	−0.028	.015	−1.837	.066
Education				
Up to 4 GCSE's	−0.012	.013	−0.856	.392
1 A-level	0.019	.014	1.385	.166
2+ A Levels	−0.002	.013	−0.184	.854
University	−0.005	.011	−0.478	.632
Income				
[0, 15.5K] GBP/year	0.020	.013	1.606	.108
[15.5K, 25.5K] GBP/year	−0.007	.013	−0.541	.588
[25K, 40K] GBP/year	−0.002	.011	−0.217	.828
More than 40K GBP/year	−0.011	.011	−0.982	.326
Motivation				
–	0.018	.007	2.700	.007
Self-licensing				
–	−0.009	.007	−1.251	.211
Risk				
Low	−0.002	.007	−0.363	.717
High	0.002	.007	0.363	.717
Numeracy				
Correct	−0.009	.008	−1.037	.300
Wrong	0.009	.008	1.037	.300
Ethnicity				
White	−0.016	.012	−1.358	.174
Other	0.016	.012	1.358	.174
Interaction				
[18,35] male	0.001	.014	0.067	.947
[35,45] male	−0.009	.016	−0.550	.582
[45,60] male	−0.020	.014	−1.483	.138
[60,99] male	0.028	.015	1.892	.058

Note:. *$p < .05$ when correcting for multiple comparisons.

Table 6. Robust mixed models for appeal for low verbal descriptors in wine drinkers

Variable	Estimate	*SE*	z-Value	Pr(>|z|)
Verbal descriptor				
(Intercept)	0.644	.031	20.589	<.001*
Low	0.030	.004	8.378	<.001*
Light	0.039	.004	11.064	<.001*
Lower	0.029	.004	8.075	<.001*
Lighter	0.031	.004	8.753	<.001*
Reduced	0.041	.004	11.602	<.001*
Extra low	−0.045	.004	−12.729	<.001*
Super low	−0.055	.004	−15.543	<.001*
Extra light	−0.028	.004	−7.956	<.001*
Super light	−0.041	.004	−11.644	<.001*
Sex				
Male	0.018	.019	0.932	.351
Female	−0.018	.019	−0.932	.351
Age group				
[18,35]	0.107	.043	2.469	.014
[35,45]	0.016	.031	0.502	.616
[45,60]	−0.064	.026	−2.464	.014
[60,99]	−0.058	.025	−2.298	.022
Education				
Up to 4 GCSE's	−0.046	.032	−1.447	.148
1 A-level	0.003	.030	0.111	.912
2+ A Levels	0.028	.029	0.992	.321
University	0.014	.022	0.637	.524
Income				
[0, 15.5K] GBP/year	−0.031	.031	−1.019	.308
[15.5K, 25.5K] GBP/year	0.036	.029	1.230	.219
25K, 40K] GBP/year	0.001	.023	0.056	.956
More than 40K GBP/year	−0.006	.024	−0.247	.805
Motivation				
–	0.065	.015	4.392	<.001*
Self-licensing				
–	−0.052	.015	−3.526	<.001*
Risk				
Low	0.036	.016	2.243	.025
High	−0.036	.016	−2.243	.025
Numeracy				
Correct	−0.004	.017	−0.260	.795
Wrong	0.004	.017	0.260	.795
Ethnicity				
White	−0.028	.028	−1.003	.316
Other	0.028	.028	1.003	.316
Interaction				
[18,35] male	0.041	.042	0.982	.326
[35,45] male	0.011	.031	0.362	.717
[45,60] male	−0.010	.026	−0.392	.695
[60,99] male	−0.043	.024	−1.790	.073

Note. *$p < .05$ when correcting for multiple comparisons.

Table 7. Robust mixed models for appeal for low verbal descriptors in beer drinkers

Variable	Estimate	*SE*	z-Value	Pr(>|z|)
Verbal descriptors				
(Intercept)	0.584	.032	18.069	<.001*
Low	0.019	.004	5.062	<.001*
Light	0.049	.004	12.741	<.001*
Lower	0.014	.004	3.609	<.001*
Lighter	0.036	.004	9.463	<.001*
Reduced	0.018	.004	4.797	<.001*
Extra low	−0.035	.004	−9.158	<.001*
Super low	−0.051	.004	−13.305	<.001*
Extra light	−0.015	.004	−3.971	<.001*
Super light	−0.036	.004	−9.237	<.001*
Sex				
Male	−0.017	.020	−0.842	.400
Female	0.017	.020	0.842	.400
Age group				
[18,35]	0.091	.033	2.774	.006
[35,45]	0.008	.037	0.211	.833
[45,60]	−0.013	.033	−0.395	.693
[60,99]	−0.086	.036	−2.404	.016
Education				
Up to 4 GCSE's	−0.012	.032	−0.363	.717
1 A-level	0.052	.033	1.578	.115
2+ A Levels	−0.040	.032	−1.255	.209
University	0.000	.025	−0.008	.993
Income				
[0, 15.5K] GBP/year	−0.049	.030	−1.626	.104
[15.5K, 25.5K] GBP/year	0.031	.031	1.008	.313
[25K, 40K] GBP/year	0.035	.027	1.299	.194
More than 40K GBP/year	−0.017	.026	−0.644	.520
Motivation				
–	0.100	.016	6.185	<.001*
Self-licensing				
–	−0.026	.016	−1.624	.104
Risk				
Low	0.033	.016	2.040	.041
High	−0.033	.016	−2.040	.041
Numeracy				
Correct	−0.031	.020	−1.541	.123
Wrong	0.031	.020	1.541	.123
Ethnicity				
White	−0.026	.028	−0.928	.353
Other	0.026	.028	0.928	.353
Interaction				
[18,35] male	0.003	.032	0.108	.914
[35,45] male	0.035	.037	0.958	.338
[45,60] male	−0.059	.033	−1.811	.070
[60,99] male	0.020	.035	0.577	.564

Note. *$p < .05$ when correcting for multiple comparisons.

Table 8. Robust mixed models for perceived strength for high verbal descriptors in wine drinkers

Variable	Estimate	*SE*	z-Value	Pr(>|z|)
Verbal descriptor				
(Intercept)	1.119	.007	172.065	<.001*
High	−0.034	.002	−21.432	<.001*
Strong	−0.029	.002	−18.145	<.001*
Higher	−0.031	.002	−19.649	<.001*
Stronger	−0.028	.002	−17.388	<.001*
Extra strong	0.023	.002	14.706	<.001*
Super strength	0.042	.002	26.716	<.001*
Extra high	0.019	.002	12.256	<.001*
Super high	0.036	.002	22.937	<.001*
Sex				
Male	−0.004	.004	−0.997	.319
Female	0.004	.004	0.997	.319
Age group				
[18,35]	0.012	.009	1.336	.182
[35,45]	−0.003	.006	−0.441	.659
[45,60]	0.005	.005	0.923	.356
[60,99]	−0.014	.005	−2.678	.007
Education				
Up to 4 GCSE's	0.003	.007	0.505	.614
1 A-level	0.010	.006	1.657	.097
2+ A Levels	−0.003	.006	−0.590	.555
University	−0.010	.005	−2.205	.027
Income				
[0, 15.5K] GBP/year	0.001	.006	0.117	.907
[15.5K, 25.5K] GBP/year	−0.002	.006	−0.337	.736
[25K, 40K] GBP/year	0.004	.005	0.821	.412
More than 40K GBP/year	−0.003	.005	−0.536	.592
Motivation				
–	−0.004	.003	−1.346	.178
Self-licensing				
–	0.001	.003	0.353	.724
Risk				
Low	0.007	.003	2.082	.037
High	−0.007	.003	−2.082	.037
Numeracy				
Correct	0.000	.004	0.007	.994
Wrong	0.000	.004	−0.007	.994
Ethnicity				
White	0.006	.006	0.996	.319
Other	−0.006	.006	−0.996	.319
Interaction				
[18,35] male	0.011	.009	1.272	.204
[35,45] male	−0.021	.006	−3.295	.001*
[45,60] male	0.013	.005	2.551	.011
[60,99] male	−0.003	.005	−0.682	.495

Note. *$p < .05$ when correcting for multiple comparisons.

Table 9. Robust mixed models for perceived strength for high verbal descriptors in beer drinkers

Variable	Estimate	*SE*	*z*-Value	Pr(>|z|)
Verbal descriptor				
(Intercept)	1.233	.011	117.173	<.001*
High	−0.077	.003	−24.814	<.001*
Strong	−0.064	.003	−20.420	<.001*
Higher	−0.070	.003	−22.471	<.001*
Stronger	−0.058	.003	−18.624	<.001*
Extra strong	0.055	.003	17.823	<.001*
Super strength	0.098	.003	31.502	<.001*
Extra high	0.042	.003	13.510	<.001*
Super high	0.073	.003	23.494	<.001*
Sex				
Male	−0.003	.007	−0.457	.6480
Female	0.003	.007	0.457	.6480
Age group				
[18,35]	0.005	.011	0.493	.6220
[35,45]	0.014	.012	1.131	.2580
[45,60]	−0.013	.011	−1.213	.2250
[60,99]	−0.006	.012	−0.518	.6050
Education				
Up to 4 GCSE's	0.000	.010	−0.040	.9680
1 A-level	−0.002	.011	−0.181	.8570
2+ A Levels	0.000	.010	−0.028	.9770
University	0.003	.008	0.320	.7490
Income				
[0, 15.5K] GBP/year	−0.005	.010	−0.470	.6380
[15.5K, 25.5K] GBP/year	−0.007	.010	−0.719	.4720
[25K, 40K] GBP/year	0.005	.009	0.597	.5500
More than 40K GBP/year	0.007	.009	0.778	.4360
Motivation				
–	−0.012	.005	−2.309	.0210
Self-licensing				
–	−0.001	.005	−0.277	.7820
Risk				
Low	0.002	.005	0.369	.7120
High	−0.002	.005	−0.369	.7120
Numeracy				
Correct	0.007	.006	1.068	.2850
Wrong	−0.007	.006	−1.068	.2850
Ethnicity				
White	0.008	.009	0.857	.3920
Other	−0.008	.009	−0.857	.3920
Interaction				
[18,35] male	0.005	.010	0.489	.6250
[35,45] male	−0.002	.012	−0.201	.8410
[45,60] male	0.008	.011	0.721	.4710
[60,99] male	−0.010	.011	−0.904	.3660

Note. *$p < .05$ when correcting for multiple comparisons.

Table 10. Robust mixed models for appeal for high verbal descriptors in wine drinkers

Variable	Estimate	*SE*	z-Value	Pr(>|z|)
Verbal descriptor				
(Intercept)	0.790	.035	22.628	<.001*
High	0.028	.003	9.863	<.001*
Strong	0.023	.003	8.034	<.001*
Higher	0.017	.003	6.161	<.001*
Stronger	0.013	.003	4.481	<.001*
Extra strong	−0.014	.003	−4.937	<.001*
Super strength	−0.026	.003	−9.340	<.001*
Extra high	−0.017	.003	−6.004	<.001*
Super high	−0.023	.003	−8.257	<.001*
Sex				
Male	0.047	.021	2.277	.023
Female	−0.047	.021	−2.277	.023
Age group				
[18,35]	0.014	.048	0.290	.772
[35,45]	−0.028	.034	−0.804	.421
[45,60]	0.006	.029	0.192	.848
[60,99]	0.008	.028	0.294	.769
Education				
Up to 4 GCSE's	0.013	.035	0.380	.704
1 A-level	−0.016	.033	−0.485	.628
2+ A Levels	0.046	.032	1.457	.145
University	−0.043	.025	−1.748	.081
Income				
[0, 15.5K] GBP/year	0.007	.034	0.204	.838
[15.5K, 25.5K] GBP/year	0.069	.032	2.147	.032
[25K, 40K] GBP/year	0.002	.026	0.082	.935
More than 40K GBP/year	−0.078	.027	−2.901	.004
Motivation				
–	0.002	.016	0.095	.924
Self-licensing				
–	0.067	.016	4.082	<.001*
Risk				
Low	−0.034	.018	−1.928	.054
High	0.034	.018	1.928	.054
Numeracy				
Correct	−0.026	.019	−1.352	.176
Wrong	0.026	.019	1.352	.176
Ethnicity				
White	−0.018	.031	−0.571	.568
Other	0.018	.031	0.571	.568
Interaction				
[18,35] male	−0.034	.047	−0.718	.473
[35,45] male	0.023	.035	0.663	.508
[45,60] male	0.003	.028	0.111	.912
[60,99] male	0.007	.026	0.284	.776

Note. *$p < .05$ when correcting for multiple comparisons.

Table 11. Robust mixed models for appeal for high verbal descriptors in beer drinkers

Variable	Estimate	*SE*	*z*-Value	Pr(>|z|)
Verbal descriptor				
(Intercept)	0.709	.037	19.319	<.001*
High	0.022	.004	6.032	<.001*
Strong	0.049	.004	13.279	<.001*
Higher	0.013	.004	3.430	.001*
Stronger	0.023	.004	6.159	<.001*
Extra strong	−0.010	.004	−2.737	.006
Super strength	−0.033	.004	−8.916	<.001*
Extra high	−0.026	.004	−6.926	<.001*
Super high	−0.038	.004	−10.321	<.001*
Sex				
Male	0.015	.023	0.680	.496
Female	−0.015	.023	−0.680	.496
Age group				
[18,35]	0.063	.037	1.697	.090
[35,45]	−0.008	.042	−0.188	.851
[45,60]	−0.035	.037	−0.960	.337
[60,99]	−0.020	.041	−0.490	.624
Education				
Up to 4 GCSE's	−0.027	.037	−0.742	.458
1 A-level	0.073	.037	1.962	.050
2+ A Levels	0.002	.036	0.068	.946
University	−0.048	.029	−1.678	.093
Income				
[0, 15.5K] GBP/year	−0.026	.034	−0.765	.445
[15.5K, 25.5K] GBP/year	0.029	.035	0.832	.406
[25K, 40K] GBP/year	−0.011	.030	−0.373	.709
More than 40K GBP/year	0.008	.030	0.274	.784
Motivation				
–	0.022	.018	1.178	.239
Self-licensing				
–	0.102	.019	5.510	<.001*
Risk				
Low	−0.012	.018	−0.630	.528
High	0.012	.018	0.630	.528
Numeracy				
Correct	−0.001	.022	−0.049	.961
Wrong	0.001	.022	0.049	.961
Ethnicity				
White	−0.035	.031	−1.121	.262
Other	0.035	.031	1.121	.262
Interaction				
[18,35] male	−0.009	.036	−0.254	.799
[35,45] male	0.028	.042	0.677	.499
[45,60] male	−0.043	.037	−1.163	.245
[60,99] male	0.024	.040	0.595	.552

Note. *$p < .05$ when correcting for multiple comparisons.

verbal descriptors, with the exception of males aged 35–45 years who perceived the different high verbal descriptors in wine as denoting lower alcohol strength. These findings are encouraging for future regulations regarding low alcohol labelling as different verbal descriptors appear to be perceived similarly across different demographic groups.

Furthermore, the results showed that those with higher, compared with a lower motivation to reduce alcohol consumption in the next 6 months perceived the low verbal descriptors as higher in strength and more appealing. These results are in line with previous empirical work demonstrating that high motivation to reduce consumption is associated with changes in actual consumption behaviours (Deci & Ryan, 1980; DiClemente *et al.*, 1999), although the causal nature of this association is unclear.

The analyses also showed that high self-licensing is associated with lower liking of low verbal descriptors (for wine only), but greater liking of high verbal descriptors (for both wine and beer). This is intriguing given that past empirical research in food and tobacco shows that self-licencers overindulge in products labelled low strength (Khan & Dhar, 2006; see also review by Shemilt *et al.*, 2017). The findings from the present research suggest that those who demonstrate self-licensing in their selection and consumption behaviours are those who find low/er strength labelled products as less appealing. This indicates that high self-licencers may act instrumentally when opting for products labelled low strength, and not in line with what they perceive to be the most desirable product. Further research using behavioural outcomes is needed to elucidate this finding.

Strengths and limitations with future research directions

This is the first study to examine perceived alcohol strength and appeal of different verbal descriptors of low and high alcohol strength products using a large sample of weekly wine and beer drinkers taken from the general population, sampled across age, sex, SES, and geographical region in the United Kingdom. Replications with samples drawn from non-UK contexts, and using other types of alcoholic drinks as well as alternative verbal descriptors of alcohol strength would help to further understand the findings from this study.

In interpreting the results, there are several limitations that might affect the robustness and generalizability of the findings. First, the study was conducted online. While there is some evidence that attitudes assessed using online sampling frames (such as Mechanical Turk) can differ from those assessed using representative samples interviewed face-to-face (Berinsky, Huber, & Lenz, 2012), we addressed this concern by recruiting the online sample via a research agency to ensure sampling across a nationally representative panel of the UK population. Furthermore, we mitigated against possible biases in online responding, by employing attention checks to screen against inattentive responders.

We were further limited by the lack of validated scales to measure our primary and secondary outcomes as well as some of the individual difference indices including self-licensing and motivation to reduce consumption. Future studies could further examine the validity of the measures developed in this research and extend the present findings with alternative measures of the constructs of interest. The current study also relied on self-report measures of individual difference characteristics (such as self-licensing), which may not necessarily reflect participants' actual characteristics due to social desirability biases. Future studies could usefully try and address the potential for socially desirable responding.

We did not measure motivation to adhere to government intake guidelines for two reasons. First, people's understanding of government intake guidelines is generally poor

(ONS, 2010). Second, to keep the survey length manageable for participants we measured potentially moderating variables of likely greater salience, including self-licensing and motivation to reduce consumptions. Future research may consider motivation to adhere to government intake guidelines as a potential moderator.

Due to our approach to sampling, participants who self-reported having no preference for wine or beer were randomized to respond to only one type of drink. They could, however, have responded to both questions for wine and beer. In order to avoid possible carry-over effects from one type of drink to another, we opted against asking participants to answer questions for both types of drink.

Another limitation is that the study assessed participants' perceptions of verbal descriptors of alcohol strength and not their behavioural responses (selection or consumption) to alcohol with such descriptors. While judgements of appeal are likely to predict behavioural responses (Ajzen, 2001), the strength of this prediction is unknown in the current context. Future studies could usefully extend the current findings using measures of selection and consumption.

Even though we chose to examine the impact of low and high alcohol strength labelling amongst UK consumers, the findings may have implications for contexts beyond the United Kingdom, such as the United States, Canada, and Germany where low strength and no-alcohol products are a growing market ('Big brewers see strong potential for weak beer', 2016; Wine Intelligence, 2013). The findings may be applicable also to contexts with high abstinence levels (Africa and Gulf countries) where lower strength products may be entry level products to expand the market and reduce levels of abstinence (Babor *et al.*, 2010). Replications in other countries will be needed so that we can understand any boundary conditions to our results as well as the impact on population health across different cultural contexts.

Policy implications

The present study aimed to examine how weekly wine and beer drinkers perceive the strength of different verbal descriptors of alcohol strength with the view of aiding decision-making in the context of imminent legislative changes to alcohol labelling rules in the United Kingdom (Department of Health, 2012). Possible legislative changes include extending the number of verbal descriptors that could be used to denote lower alcohol strength, and extending the legislated strength limit to include products lower than the current average on the market but higher than the current legislated cap of 1.2% ABV.

Our findings suggest that the effectiveness of alcohol labels at communicating product strength might be enhanced by taking into account the seeming perceptual clustering of verbal descriptors into two groups, one with, and one without, intensifiers. For products with low or lower alcohol strengths, the two clusters seem to be best represented by *Low* and *Super Low* verbal descriptors, based on the amount of differentiation these provide from products labelled as *Regular*. Furthermore, the impact of verbal descriptors on individuals' perceptions of strength and appeal was similar for wine and beer, suggesting that policymakers may not need to differentiate between these two types of products when regulating for low/er strength alcohol labelling. Even though the current study sample consisted of weekly wine and beer drinkers (64% of men and more than 53% of women in Great Britain are weekly alcohol drinkers, with wine being the preferred drink of choice [47%] followed by beer, stout, and cider [40%], see ONS, 2016), suggesting a high familiarity with alcohol products, only a minority of participants seemed knowledgeable of current regulations, and perceptions of alcohol strength differed

considerably. This points to a need for any new legislation to be communicated more effectively to consumers than current legislation.

Furthermore, some existing alcohol labelling has used similar terms to the ones used in this study (e.g., *light*) to refer to reduced calorie content, rather than reduced alcohol content. In our study, we explicitly told participants that the verbal descriptors referred to alcohol strength. Any change to the legislation should, however, aim to make the description of alcohol strength as clear as possible and avoid any possible misunderstandings that the verbal descriptors may denote characteristics of the product other than its alcohol content. This could be achieved by including the terms Alcohol (e.g., 'Low Alcohol') or Strength (e.g., 'Low Strength') to clarify to consumers that the accompanying verbal descriptor refers to alcohol strength.

An important caveat to bear in mind regarding the above implications is that they refer to people's perceptions of strength and appeal; how these are reflected in actual behaviours is currently unknown. In addition, any changes to legislation of lower strength alcohol labelling will need to be evaluated not only by examining how people respond to these labels, but also by taking a whole systems approach and investigating the associated branding and marketing changes that accompany changes to alcohol labelling.

Conclusions

Verbal descriptors of low/er strength alcohol wine and beer form clusters and can effectively communicate two categories of strength that are lower than an average strength product. Seventeen of 18 verbal descriptors for lower strength products were perceived as denoting products far higher in strength than the currently legislated cap of 1.2% ABV for low alcohol products. The appeal of alcohol products reduced the more the verbal descriptors implied a deviation from *Regular*. The impact of these verbal descriptors on selection and consumption awaits testing.

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Conflict of interest

All authors declare no conflict of interest.

References

Agostinelli, G., & Grube, J. (2002). Alcohol counter-advertising and the media. *Alcohol Research & Health*, *26*, 15–21.

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*, *52*, 27–58. https://doi.org/10.1146/annurev.psych.52.1.27

Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., . . . Rossow, I. (2010). *Alcohol: No ordinary commodity – research and public policy* (2nd ed.). Oxford, UK: Oxford University Press.

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. (2001). *The alcohol use disorders identification test. Guidelines for use in primary care*. Geneva, Switzerland: World Health Organization.

Berinsky, A. J., Huber, G. A., & Lenz, G. S. (2012). Evaluating online labor markets for experimental research: Amazon. com's Mechanical Turk. *Political Analysis*, *20*, 351–368. https://doi.org/10.1093/pan/mpr057

Big brewers see strong potential for weak beer (2016, July). *Reuters*. Retrieved from http://www.reuters.com/article/us-beverages-alcohol-idUSKCN0ZT0FB

Borland, R., Yong, H. H., King, B., Cummings, K. M., Fong, G. T., Elton-Marshall, T., . . . McNeill, A. (2004). Use of and beliefs about light cigarettes in four countries: Findings from the International Tobacco Control Policy Evaluation Survey. *Nicotine & Tobacco Research*, *6*(Suppl. 3), S311–S321. https://doi.org/10.1080/14622204123313207 16

Bretz, F., Hothorn, T., & Westfall, P. (2010). *Multiple comparisons using R*. Boca Raton, FL: CRC Press.

Bui, M., Burton, S., Howlett, E., & Kozup, J. (2008). What am I drinking? The effects of serving facts information on alcohol beverage containers. *Journal of Consumer Affairs*, *42*, 81–99. https://doi.org/10.1111/j.1745-6606.2007.00095.x

Burton, R., Henn, C., Lavoie, D., O'Connor, R., Perkins, C., Sweeney, K., . . . Musto, V. (2017). A rapid evidence review of the effectiveness and cost-effectiveness of alcohol control policies: An English perspective. *The Lancet*, *389*, 1558–1580. https://doi.org/10.1016/S0140-6736(16)32420-5

Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): An effective brief screening test for problem drinking. *Archives of Internal Medicine*, *158*, 1789–1795. https://doi.org/10.1001/archinte.158.16.1789

Canadian Food Inspection Agency (2017). *Labelling requirements for alcoholic beverages*. Retrieved from http://www.inspection.gc.ca/food/labelling/food-labelling-for-industry/alcohol/eng/1392909001375/1392909133296

Conner, M., Warren, R., Close, S., & Sparks, P. (1999). Alcohol consumption and the theory of planned behavior: An examination of the cognitive mediation of past behavior. *Journal of Applied Social Psychology*, *29*, 1676–1704. https://doi.org/10.1111/j.1559-1816.1999.tb02046.x

Crockett, R. A., King, S. E., Marteau, T. M., Prevost, A. T., Bignardi, G., Roberts, N. W., . . . Jebb, S. A. (under review). Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. *Cochrane Database of Systematic Reviews*.

De Visser, R. O., & Birch, J. D. (2012). My cup runneth over: Young people's lack of knowledge of low-risk drinking guidelines. *Drug and Alcohol Review*, *31*, 206–212. https://doi.org/10.1111/j.1465-3362.2011.00371.x

Deci, E. L., & Ryan, R. M. (1980). The empirical exploration of intrinsic motivational processes. *Advances in Experimental Social Psychology*, *13*, 39–80. https://doi.org/10.1016/S0065-2601(08)60130-6

Department of Health (2012). *Public Health Responsibility Deal – A8(a) Alcohol Unit Reduction*. Retrieved from https://responsibilitydeal.dh.gov.uk/pledges/pledge/?pl=22

Department of Health (2014). *Responsibility Deal Alcohol Network – Pledge to remove 1 billion units of alcohol from the market by end 2015 – First interim monitoring report*. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/389573/RDAN_-_Unit_Reduction_Pledge_-_1st_interim_monitoring_report.pdf

DiClemente, C. C., Bellino, L. E., & Neavins, T. M. (1999). Motivation for change and alcoholism treatment. *Alcohol Research and Health*, *23*, 87–92.

Food Standards Australia & New Zealand (2014). *Labelling of alcoholic beverages: User guide*. Retrieved from http://www.foodstandards.gov.au/code/userguide/Documents/Guide%20to%20Labelling%20of%20Alcoholic%20Beverages.pdf

Furtwängler, N. A. F. F., & de Visser, R. O. (2017a). Motivation to adhere to unit-based guidelines for alcohol consumption, and ability to do so is limited among university students". *Drugs: Education, Prevention & Policy*, *24*, 418–425. https://doi.org/10.1080/09687637.2016.1211991

Furtwängler, N. A. F. F., & de Visser, R. O. (2017b). University students' beliefs about unit-based guidelines: A qualitative study. *Journal of Health Psychology*. https://doi.org/10.1177/1359105316634449

Hammond, D., & Parkinson, C. (2009). The impact of cigarette package design on perceptions of risk. *Journal of Public Health*, *31*, 345–353. https://doi.org/10.1093/pubmed/fdp066

Heritier, S., Cantoni, E., Copt, S., & Victoria-Feser, M.-P. (2009). *Robust methods in biostatistics. Wiley Series in Probability and Statistics*. Chichester, UK: John Wiley.

Home Office, Department of Health, Baker, N., Ellison, J., Hunt, J., & May, T. (2014). *Alcohol industry takes action to tackle irresponsible drinking*. Retrieved from https://www.gov.uk/government/news/alcohol-industry-takes-action-to-tackle-irresponsible-drinking

Jones, S. C., & Gregory, P. (2009). The impact of more visible standard drink labelling on youth alcohol consumption: Helping young people drink (ir) responsibly? *Drug and Alcohol Review*, *28*, 230–234. https://doi.org/10.1111/j.1465-3362.2008.00020.x

Khan, U., & Dhar, R. (2006). Licensing effects in consumer choice. *Journal of Marketing Research*, *43*, 259–266. https://doi.org/10.1509/jmkr.43.2.259

Kozlowski, L. T., Goldberg, M. E., Yost, B. A., White, E. L., Sweeney, C. T., & Pillitteri, J. L. (1998). Smokers' misperceptions of light and ultra-light cigarettes may keep them smoking. *American Journal of Preventive Medicine*, *15*, 9–16. https://doi.org/10.1016/S0749-3797(98)00004-X

Kozlowski, L. T., & Pillitteri, J. L. (2001). Beliefs about "Light" and "Ultra Light" cigarettes and efforts to change those beliefs: An overview of early efforts and published research. *Tobacco Control*, *10*(Suppl. 1), i12–i16. https://doi.org/10.1136/tc.10.suppl_1.i12

Lipkus, I. M., Samsa, G., & Rimer, B. K. (2001). General performance on a numeracy scale among highly educated samples. *Medical Decision Making*, *21*, 37–44. https://doi.org/10.1177/0272989X0102100105

McCann, M. T., Wallace, J. M., Robson, P. J., Rennie, K. L., McCaffrey, T. A., Welch, R. W., & Livingstone, M. B. E. (2013). Influence of nutrition labelling on food portion size consumption. *Appetite*, *65*, 153–158. https://doi.org/10.1016/j.appet.2013.02.013

Morgenstern, M., Isensee, B., Sargent, J. D., & Hanewinkel, R. (2011). Attitudes as mediators of the longitudinal association between alcohol advertising and youth drinking. *Archives of Pediatrics & Adolescent Medicine*, *165*, 610–616. https://doi.org/10.1001/archpediatrics.2011.12

Morleo, M., Phillips-Howard, P., Cook, P. A., & Bellis, M. A. (2008). *North West Alcohol Information, Fact Sheet 7: Reducing alcohol content in drinks*. Retrieved from http://www.cph.org.uk/wp-content/uploads/2012/08/fact-sheet-7-reducing-alcohol-content-in-drinks.pdf

Oguz, S., Merad, S., & Snape, D. (2013). *Measuring national well-being: What matters most to personal well-being?* London, UK: Office for National Statistics.

ONS (2010). *Drinking: Adults' behaviour and knowledge in 2009*. Newport, UK: Author.

ONS (2016). *Adult drinking habits in Great Britain: 2014*. Newport, UK: Author.

ONS (2017). *Adult drinking habits in Great Britain: 2005 to 2016*. Newport, UK: Author.

Oppenheimer, D. M., Meyvis, T., & Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology*, *45*, 867–872. https://doi.org/10.1016/j.jesp.2009.03.009

Public Health England (2017). *AUDIT – C, PHE Alcohol Learning Resources*. Retrieved from https://www.alcohollearningcentre.org.uk/Topics/Latest/AUDIT-C/

Rehm, J., Lachenmeier, D. W., Jané-Llopis, E., Imtiaz, S., & Anderson, P. (2016). On the evidence base of reducing ethanol content in beverages to reduce the harmful use of alcohol. *The Lancet Gastroenterology & Hepatology*, *1*, 78–83. https://doi.org/10.1016/S2468-1253(16)30013-9

Shemilt, I., Hendry, V. L., & Marteau, T. M. (2017). What do we know about the effects of exposure to 'Low alcohol' and equivalent product labelling on the amounts of alcohol, food and tobacco people select and consume? A systematic review *BMC Public Health*, *17*, 29. https://doi.org/10.1186/s12889-016-3956-2

Stockwell, T. (2006). *A review of research into the impacts of alcohol warning labels on attitudes and behaviour*. Victoria, BC: University of Victoria, Centre for Addictions Research of BC.

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, *8*, 220–247. https://doi.org/10.1207/s15327957pspr0803_1

The European Parliament and the Council of the European Union (2011). *Regulation (EU) No 1169/2011 of the European Parliament and the Council of the European Union of 25 October 2011 on the provision of food information to consumers*. Retrieved from http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32011R1169

Vasiljevic, M., Couturier, D.-L., & Marteau, T. M. (2015). *Perceptions of alcohol strength of different low and high verbal descriptors in an undergraduate sample*. Unpublished manuscript.

Wansink, B., & Chandon, P. (2006). Can" low-fat" nutrition labels lead to obesity? *Journal of Marketing Research*, *43*, 605–617. https://doi.org/10.1509/jmkr.43.4.605

Wilkinson, C., & Room, R. (2009). Warnings on alcohol containers and advertisements: International experience and evidence on effects. *Drug and Alcohol Review*, *28*, 426–435. https://doi.org/10.1111/j.1465-3362.2009.00055.x

Wine Intelligence (2013). *Mainstream beckons for lower alcohol wines*. Retrieved from http://www.wineintelligence.com/mainstream-beckons-for-lower-alcohol-wines/

Wright, A. J., Whitwell, S. C., Takeichi, C., Hankins, M., & Marteau, T. M. (2009). The impact of numeracy on reactions to different graphic risk presentation formats: An experimental analogue study. *British Journal of Health Psychology*, *14*, 107–125. https://doi.org/10.1348/135910708X304432

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology*, *9*, 1–27. https://doi.org/10.1037/h0025848

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Supporting Information

The following supporting information may be found in the online edition of the article:

Figure S1. Perceived strength of low verbal descriptors for the wine and beer samples relative to the Regular verbal descriptor.
Figure S2. Perceived strength of high verbal descriptors for the wine and beer samples relative to the Regular verbal descriptor.
Figure S3. Liking of low verbal descriptors for the wine and beer samples relative to the Regular verbal descriptor.
Figure S4. Liking of high verbal descriptors for the wine and beer samples relative to the Regular verbal descriptor.
Figures S5. (a and b) Pairwise comparison of high verbal descriptors for wine and beer.